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SEPTEMBER 1998

FEDERAL AVIATION ADMINISTRATION

AVIATION SAFETY FROM COVER TO COVER

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FEATURES

DEPARTMENTS

FRONT COVER: Cessna's New 172 coming...
BACK COVER: ...and the New 182 going.
(Cessna Aircraft Company photos)

Dr. Paul Craig of MTSU teaches seminar atendees about "Vertical Airspace" at the NC WINGS Weekend.

WINGS OVER NORTH CAROLINA

by Phyllis Anne Duncan
Photos by Margaret Haldane

A motto on North Carolina license plates, which feature a silhouette of the Wright Flyer, declares the state "First in Flight." The fact that Kitty Hawk, NC is a seminal point in aviation history was not serendipitous—the Wright Brothers selected the windy dunes along North Carolina's coast for specific reasons: almost constantly blowing winds and privacy. On December 17, 1903 along Kill Devil Hills, they completed the first manned, powered flights, and North Carolina became the shrine of aviation.

With this rich history, it is not surprising, then, that North Carolina should be the site of the first, organized WINGS Weekend in the country.

WINGS' bureaucratic name is the Pilot Proficiency Award Program, a voluntary program developed by the FAA to encourage pilots who are not required to take recurrent training beyond a flight review and 90-day currency requirements to fly periodically with a flight instructor and attend an educational safety seminar. Administered by the FAA Aviation Safety Program, WINGS is clearly the most popular of all of FAA's outreach programs—well, except, of course, *FAA Aviation News*, but that's our opinion. In a 12-month period a pilot must take three hours of specialized flight instruction—air work, instrument work, takeoffs and landings—and attend an FAA-sponsored safety seminar. The pilot then receives a lapel pin in the form of aviator wings—hence the nickname—and a certificate from the FAA testifying to the pilot's safe attitude. The next year, the pilot can start all over again, and, in fact, can do so once a year for each of WINGS' 20 phases. The obvious benefit is recurrent training, but pilots who participate regularly in WINGS get the added benefit of a break in the cost of their aircraft insurance. Through analysis and direct survey of program participants the FAA has learned that pilots who participate in the WINGS program have fewer accidents and incidents, have a positive attitude toward compliance,

and set higher personal minimums for themselves than pilots who do not.

In the current parlance, what we have here is a win-win scenario.

But back to North Carolina.

The WINGS program has been in full effect for nearly 20 years, and the participation has been consistent. However, of more than 600,000 pilots in the U.S., only about 20,000 (3%) receive their WINGS annually. Consequently, FAA Safety Program Managers in FAA offices across the country are constantly thinking of ways to improve those numbers. In North Carolina it was a partnership among the FAA, the aviation community, and state government which fueled a concept that started with about 40 participants in 1991 and featured nearly 600 in May.

Twice a year the FAA Flight Standards District Office (FSDO) in Winston-Salem, NC holds a WINGS Weekend—an all-in-one event that offers the best in aviation: pilots, airplanes, camaraderie, junky airport food, a bushel of safety seminars, hangar flying—well, you get the picture. (Suffice it to say, anytime one can leave the hallowed halls of FAA headquarters and get out to aviation's grass roots, it is almost a spiritual catharsis, so allow me some effusion.)

Inspiration and Perspiration

Any successful endeavor is always attributed in varying proportions to a good idea plus hard work. The North Carolina WINGS Weekend is no different. John McLain, a 25-year resident of North Carolina, has had a great deal of experience with fly-ins, especially the family fly-ins held in the Northwest. McLain has conducted safety seminars as an AOPA instructor at these popular events which focused on aviation as a family gathering opportunity. He has always been a believer in the WINGS program and saw potential for increasing the WINGS participation in his home state. He discussed his idea with Tom Jones, the then Accident Prevention Program Manager at the Winston-Salem FSDO, and approached the North Carolina Department of Transportation. After some palaverin', as they call it in the south, the idea for a Saturday-Sunday event where pilots could attend not only safety seminars but also get hooked up with a flight instructor was hashed out. This way in one day pilots could complete all the requirements to earn their WINGS.

In the fall of 1991 at Harnett County Airport on a full IFR day, about 40 people showed up in response to the mailing from the FSDO. An inauspicious start perhaps, since only 14 WINGS were issued, but the idea caught on—and it was the first organized, all encompassing WINGS event in the country. Over the seven years since, the North Carolina WINGS weekend has also come to symbolize aviation partnership. The North Carolina Department of Transportation (NC-DOT) Division of Aviation became a significant sponsor and participant in the event. Without the funding and administrative support provided by Mike Wright and his NC-DOT staff the event wouldn't happen, according to FAA Safety Program Manager Larry Lambert. FBO's and technical schools offered facilities, even aircraft, and the number of volunteer flight instructors consistently increased. (A CFI, after qualifying three pilots for the WINGS program, earns his or her WINGS as well.)

This all leads up to the weekend of May 2-3, 1998 at the Piedmont-Triad International Airport in Greensboro, NC, one of the fastest growing areas of the state. It was recently announced, for example, that FedEx will be building a hub at Piedmont-Triad, considered a coup for the "triad" area cities of Winston-Salem, Greensboro, and High Point. The famous North Carolina Triangle area of the state—Raleigh, Durham, and Chapel Hill-had long attracted most of the state's investment money, new businesses, and high-tech industries. The Piedmont-Triad area had struggled for equal recognition and felt, perhaps, a little sibling rivalry.

Larry Lambert, the current Safety Program Manager for Operations at the Winston-Salem FAA FSDO, had been pointing out to me at national Aviation Safety Program meetings for several years that North Carolina had been the site of the first WINGS weekend and when was I going to do an article on it. *FAA Aviation News* boasts right under the masthead that we are "Aviation Safety From Cover to Cover," and sometimes when we have run articles about FAA events around the country, we get mail accusing us of being self-serving and not devoting every inch of column space to safety. It was a dilemma, to be sure, to want to support FAA's outreach efforts on one hand and keep the subscribers happy on the other. But sitting through a WINGS weekend, it became very clear that reporting on one state's effort to encourage and enhance safety in its pilot population is not self-serving; it is exactly what the old FAA joke satirizes-we are here to help. Very quickly, you see this is not an FAA event—the FAA is there, to be sure, advising and organizing—but the success is directly attributable to the many volunteers and sponsors whose "perspiration" made John McLain's "inspiration" a success.

1830, Friday, May 1

The floor of the maintenance training hangar of Guilford Technical Community College—located at the Piedmont-Triad International Airport—is immaculate, free of FOD and smears of grease and oil. Airplanes in various stages of assembly and disassembly line the walls. This is a hands-on learning facility, and one of the ongoing projects for students going through the college's A&P course is the restoration of a *Tripacer*. A restored Piper J-3 *Cub* is opposite, the subject of a silent auction.

In the center of the hangar is a makeshift registration booth of tables, one of which bears a large banner advertising the Aviation Safety Program. Another identifies the NC-DOT. On the large hangar door leading out to the ramp is another equally large and colorful banner, "Welcome to the North Carolina WINGS Weekend!" which was supplied by the newly formed North Carolina Aviation Foundation. Nearby the exit to the ramp is another table, set up by the Greensboro Air Traffic Control Tower. Rows of fold-up chairs occupy the hangar, dozens of folks stand about in groups of two of three, and Larry Lambert nervously checks his watch. It's difficult to see what the problem is. All the volunteer instructors have shown up for their pre-event procedures briefing, the registration packets are ready, the vendors are in place and set up, so what could be making him pace about the hangar?

On Saturday morning pilots get matched up with CFI's.

The pizza hasn't arrived.

Food is important to pilots. I mean, we've been known to fly 500 miles out of the way to a specific airport restaurant with just the right crab cakes. Scattered about the hangar are 75 CFI's, many of whom have come directly from work, with growling stomachs. True, this is a procedures and safety briefing, but everyone listens better on a full stomach. First things first, of course.

A few minutes after 1830, Larry is relieved. The pizza arrives, and the CFI's—pizza slices in one hand and a can of soda in the other—take their seats and listen to Larry and George Cline, an FAA Air Traffic Plans and Procedures Specialist sent by Greensboro Tower manager Dave Short to outline the special ATC procedures for the WINGS Weekend.

As the WINGS Weekends grew in popularity and numbers, it soon became obvious that a large staging area was needed; hence, the move to the Piedmont-Triad International Airport, which has a control tower. Coordination with air traffic control so that the WINGS Weekend traffic didn't conflict with commercial traffic was essential, and ATC soon became an important partner in the event's success. Greensboro ATCT establishes specific call signs and sets aside specific transponder codes for WINGS Weekend participants. After picking up their registration packets and meeting up with their assigned instructors, the teams must stop by the ATC table next to the hangar exit for their callsign and discrete code.

Cline emphasized this over and over. It seems that on departure, pilots and CFI's have no trouble remembering to use the callsign and transponder code. However, after three hours in the practice area out of contact and squawking VFR, they sometimes forget to use the callsign when calling Greensboro Approach Control to return to base. For example, all aircraft participating in the WINGS Weekend were given a callsign beginning with "WINGS." So, if you were the first CFI/pilot team, your callsign would be WINGS201 and the assigned transponder code would be 0201; WINGS202, transponder code 0202; etc.

Using a chart, Cline outlined the three practice areas to be used for WINGS Weekend air work, highlighting the restricted areas to avoid, and assured the instructors that controllers would adjust the amount of traffic sent to each area.

Lambert went over the practical and safety matters-checking back in after flying, safety pilot duties while the other pilot was under the hood, and extra vigilance for traffic while in the practice areas. Lambert also reviewed the requirements for the three hours of instruction: one hour of air work, one hour of hood time, one hour of takeoffs and landings. The CFI's had their opportunity for questions, and everyone filed out into a suddenly rainy night, hoping for better weather the next morning.

0730, Saturday, May 2

Though registration didn't begin officially until 0730, plenty of pilots showed up as much as an hour ahead of time, so popular is this WINGS Weekend. What seemed like chaos is actually well-controlled thanks to the administrative and logistical services of the NC-DOT. Five hundred sixty-three people have pre-registered, but more than 600 show up after walk-in registration is allowed. Let's put this in perspective, though. Some come only for the flying, either Saturday or Sunday, because they already have a seminar. Some come one day for the seminars, the next day for the flying. Some come only for the seminars. Although for a while it did seem as if all 600 people showed up at once, the spirit of community is evident. Enough CFI's

have volunteered to handle the number of people who want to fly, and some CFI's have brought their own airplanes, which they have donated, along with their time, for the pilots to use. The FBO's on the airport have stepped in as well and offered airplane rentals at a special WINGS Weekend fee—anything to assure that anyone who wants to fly and qualify for their WINGS will get to do so. Aviation, it seems, has stumbled on the secret to world peace. Would that we could export it.

After a repeat of the procedures from the night before, pilots line up to get their CFI assignments, then pilots and CFI's pair up to discuss the safety issues again, and finally the pilot/CFI pairs line up to get their discrete call signs and transponder codes. Despite the worrisome rain the night before, the weather is cool and severe clear—a great day for flying.

The seminars began at 0830, and the topics lined up were just as impressive as the instructors. The instructors, some from within FAA, such as Flight Service and Air Traffic, are understandable, but many others are volunteers, donating two days of their time to a worthwhile cause. Some, like Chief Flight Instructor Paul Craig of Middle Tennessee State University, seem to have forgotten he no longer lives and works in North Carolina. Dr. Craig started out as a volunteer CFI for the NC WINGS Weekend but continues to return and provide his services for the event. This year he rolled up in MTSU's Cessna 404 with eight MTSU other volunteer flight instructors to support the weekend.

The Pinch Hitter Ground School kicked off the seminars, and as aviation reflects our growing diversity, it was a change to see male companions of female pilots as well as teenaged children of pilots learning what they could do to help in an in-flight emergency. Taught by Karen Smith, a Wilmington, NC Air Traffic Controller, the Pinch Hitter course was attended by nearly 40 people, some of whom would later get to fly with their companions' flight instructor to make it a well-rounded experience.

The other seminars began at 0855 after the pilot/CFI assignments and briefing and included such important topics as Vertical Airspace, which showed complex airspace three dimensionally. Actually, this seminar is worth singling out—they all were, but this was particularly unique. Taught by Dr. Craig of MTSU, the seminar attempts to get pilots to think three-dimensionally, a good idea since we operate three-dimensionally. Craig cut up several sectional charts of the Big Island of Hawaii—a section each time the elevation changed. Each elevation was glued to foam board then re-assembled to provide a three-dimensional view of that island. In this manner, it is easy for a pilot to visualize how quickly and abruptly terrain can rise—a real eye-opener for the attendees.

Other topics included "Preflight Your Instrument," an in-depth examination of gyro failure and partial panel skills; "GPS," which explained the future of the airspace system when GPS becomes the primary navigational aid; "Aeronautical Decision Making," which gets pilots to consider their in-flight decisions according to the airspace system in which they operate; "Flight Service and METAR/TAF," taught by specialists from the Raleigh Automated FSS; "Understanding ATC," which features ATC specialists from Greenboro, Charlotte, and Raleigh ATCT's; "It's All in the Clouds," which enhanced pilot skills in interpreting weather; "Making Your Own Rules," a Back-to-Basics program which encourages pilots to set their own personal miminums based on a number of interrelated factors; "Accidents at Non-Towered Airports," which was a trend analysis presented by the NTSB; "Is It Legal?" a preventive maintenance seminar conducted by an FAA inspector; "Spatial Disorientation," featuring the Vertigon; "You're on the Radio," which points out the problems with using non-standard phraseology; and "Check Ride Blues," a how-to seminar on being ready for your check ride.


ATC's George Cline (standing right) explains call signs and transponder codes.

The seminars were repeated on Saturday and then again on Sunday for the next group of WINGS applicants. What a day, and what good information to be learned. All the seminars were standing room only, and that is a tribute to the quality of the presenters and the importance of their topics.

After a long day of classroom work and flying, it was time, of course, to eat again—this time some East Carolina barbeque. At a Pilot Appreciation Banquet sponsored by Atlantic Aero, Piedmont Aviation, and the Greensboro Airport Authority, local awards were distributed to pilots and mechanics for their safety efforts in the past year. This, too, was a partnership effort, with all parties recognizing the hard work and volunteerism that makes the NC WINGS Weekend such a success. The featured speaker was writer Stephen Coontz, author of such aviation thrillers as *Flight of the Intruder* and *Under Siege*.

0730, Sunday, May 3

Unfortunately for me, Sunday meant a return to the bureaucratic halls of Washington, DC, which was pretty difficult when the day once again dawned bright and clear. As I headed away from the airport, the first of Sunday's WINGS pilots and CFI's were taking to the air, and in spirit, at least, I was with them.

Officially, of course, I have to say that the WINGS Program is a good FAA outreach program, but I can say as a pilot and CFI that it is one of the easiest ways a pilot can be assured of honing his or her skills beyond a flight review or currency requirements. Events such as North Carolina's WINGS Weekend make it seem more like enjoyment than work, though it is hard, constant work to remain a good, safe pilot.

The bad news was, I had to leave. The good news is the FAA in North Carolina holds two WINGS Weekends a year, and the next one is scheduled for October 31 - November 1, 1998 at Goldsboro, NC. Out-of-state pilots (even Northerners—just joking) are welcome.

Ya'll come back now, y'hear?

The list of thank you's is long, so let me thank everyone at the Winston-Salem FSDO, especially Safety Program Manager Larry Lambert and Office Manager Rod Carlson, everyone at the NC-DOT Division of Aviation, everyone at—well, everyone in North Carolina for making the WINGS Weekend a success.

For information on the October WINGS Weekend, contact Larry Lambert at (336) 631-5147, extension 43, or at Larry.F.Lambert@faa.dot.gov .

For further information on the WINGS program, contact the Safety Program Manager at your local FAA FSDO and ask for a copy of Advisory Circular 61-91, "Pilot Proficiency Award Program."

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ALCOHOL AND AIRCRAFT DON'T MIX

by Ken Knopp

In our November/December 1997 issue we ran an article that contained—by the time we printed it—some outdated information, and we apologize for any problems. The article was "Is It OK to Use RFG In Your STC Without MTBE?" Mr. Ken Knopp, a fuels engineer, provided us with the following information which should clarify the issue.—Editor

Many pilots may not be aware that, indeed, their aircraft and their lives may be in danger from another type of alcohol if autogas is being used under the current STC—not from the kind of alcohol we used in mixed drinks but the kind that the fuel industry has been adding to the automotive fuels we use. Automobile gasoline is currently approved for use on aircraft with appropriate STC's that meet the American Society for Testing and Material (ASTM) specification D439 or D4814 with the following exception: the automobile gasoline cannot contain alcohol.

Many older aircraft with an STC for automobile gasoline may only refer to ASTM D439; however, the FAA does recognize D4814 as an equivalent to D439. However, the operator of the aircraft must take action to assure that automobile gasoline with alcohol is not used. The alcohol may be added before distribution to meet Environmental Protection Agency (EPA) requirements for oxygen content by adding either methanol or ethanol.

Two other oxygenates used are methyl-tertiary-butyl ether (MTBE) and ethyl-tertiary-butyl ether (ETBE), which are approved for use with an STC, since they do not have any of the dangerous effects of methanol and ethanol.

There are three primary reasons for not using an automobile gasoline that contains methanol or ethanol. First, the addition of alcohol to gasoline adversely affects the volatility of the fuel, which could cause vapor lock. Second, alcohol present in automobile gasoline is not compatible with the rubber seals and materials used in aircraft. Phase separation is the last reason, which happens when the fuel is cooled as a result of the aircraft's climbing to higher altitude. When the alcohol separates from the gasoline, it may carry water that has been held in solution and that cannot be handled by the sediment bowl.

In order to avoid any of these problems, a simple test can be done to screen for the presence of methanol or ethanol. All that is required is a transparent container (something like a fuel strainer, test tube, or graduated cylinder) and a small amount of water. First, add a small amount of water to the container and mark the container at the water's highest level. Next, add about nine parts gasoline to the one part water (i.e., one ounce of water, nine ounces of gasoline). Cover and shake to allow the water to mix with the gasoline. After mixing, let the water and gasoline settle. If alcohol is present in the gasoline, the water will absorb it, and the amount of water will appear to increase, indicating the gasoline should not be used in the aircraft. However, if the water level remains the same, no alcohol is present in the gasoline, and it can be used in the aircraft.

Mr. Knopp is a research engineer at the FAA Technical Center working with propulsion and fuel issues for the Airport and Aircraft Safety Research and Development Division.

U.S. Department of Transportation
Federal Aviation Administration

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JUN 0 4 1998

Mr. Earl Lawrence
Executive Director, Government Programs
Experimental Aviation Association (EAA)
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Dear Mr Lawrence:

This letter is in response to your letter dated May 28, 1998, concerning a recent Federal Aviation Administration (FAA) Aviation Safety Program Newsletter that highlighted autogas use in a negative way. Several comparisons between autogas and avgas were cited in the newsletter that infer airplanes and engines that have Supplemental Type Certificates (STCs) approved for autogas use are not as safe as airplanes or engines that use avgas exclusively. This is not an accurate representation of the operational service history for these products that use autogas. The sixteen year service history for airplanes and engines using autogas is good.

The newsletter cites a 1976 Textron Lycoming service information document and a Teledyne Continental Engine Technical Bulletin that defines certain concerns with autogas use. At that time, there were questions and issues that needed to be answered. However, since that time a tremendous amount of airplane, engine, and fuel testing has been accomplished among EAA, FAA, and other organizations. Autogas use has been extensively compared, tested, and analyzed. Autogas has been shown to be an acceptable alternative to avgas for the airplanes and engines approved for such use. Airplanes and engines approved for autogas use have met the FAA certification requirements for engine detonation, engine cooling, fuel flow, hot fuel testing, fuel system compatibility, vapor lock, and performance. The newsletter also cited a report about aggravated engine valve seat recession (wear) with the use of autogas. Extensive FAA Technical Center testing concluded that valve seat recession with autogas use is not significantly different from avgas use.

In summary, there are numerous studies and technical reports available comparing autogas to avgas for use in certificated airplanes and engines. The service history for airplanes and engines using autogas has been good and is comparable to avgas.

We thank you for bringing this issue to our attention and we hope this clarifies the Small Airplane Directorate's position on approved autogas use in 14 CFR part 23 airplanes.

Sincerely,

Ronald K. Rathgeber

for Michael Gallagher
Manager
Small Airplane Directorate

A PRIMER ON PRIMERS

by Patrick Benton

Pilots are cautioned to follow the recommended priming techniques in their respective aircraft's pilot operating handbook or flight manual.
—Editor

ANATOMY OF A PRIMER SYSTEM

The engine priming system seems to be one of the most misunderstood systems on light aircraft. What exactly does the primer do, and how does it do it? Should you use the primer for every start or just when it's cold? Is it okay to prime the engine by pumping the throttle a few times? These are some of the questions frequently asked by new and experienced pilots, including flight instructors.

To develop safe and efficient priming techniques, it is necessary to understand the system and how it works. A primer system is used on aircraft engines to introduce a small amount of atomized fuel into the engine to improve cold starting. The priming system is a stand-alone system and is not part of the carburetor.

The system consists of a fuel pump, discharge nozzles, and interconnecting plumbing. There are two types of systems in use. One type uses a small, manually operated fuel pump located in the cockpit. The other type uses the aircraft electric boost pump to provide fuel pressure to the discharge nozzles. The electric primer system also incorporates an electrically operated valve to control the fuel flow to the nozzles. The discharge nozzles and plumbing (normally one-eighth inch tubing) are the same for both systems. Most small aircraft use a manual primer system, while large or multiengine aircraft may have electric primer systems.

The discharge nozzles are very important to the proper operation of the system. They have a small discharge orifice, which causes the fuel to atomize much like the nozzle on a spray bottle of window cleaner. The nozzles usually are located in the cylinder head, in front of the intake valve. Some engines have a nozzle in all the cylinders, while others have nozzles in only some of the cylinders. Sometimes there is only one nozzle for the entire engine. When a single nozzle is used, it normally is located in a central location in the induction manifold, rather than in the cylinder head.

PRIMER SYSTEM OPERATION

The manual primer system uses a single acting or one-way piston type pump located in the cockpit. When the pump is pulled out, fuel from the main fuel line is drawn into the pump through a check valve. When the pump is pushed in, the fuel exits through a second check valve into the primer lines and out to the discharge nozzles. When operating the manual type of primer, you should wait a few seconds after pulling the pump out before pushing it back in. This allows time for the fuel to fill the pump chamber. If the pump is hard to operate, the seals may be bad or the nozzles could be plugged. Have your mechanic check the system if the pump does not operate easily or priming does not seem to be effective.

Manual primer pumps are equipped with a locking feature on the pump. This allows the primer pump to be locked in the closed position, which prevents the pump from accidentally opening in flight. If the pump does open with the engine running, fuel will be drawn through the pump and into the engine. This will cause an over rich fuel/air mixture, which will result in power loss or engine stoppage.

An electric primer system uses the boost or auxiliary fuel pump to provide fuel pressure for priming. An electric solenoid valve controls the fuel flow to the nozzles and is operated by a switch in the cockpit labeled "prime." With the boost pump on, the prime switch can be turned on to send fuel to the cylinders. This is a spring-loaded-off type switch; therefore, you must hold it in the primer position. Keep in mind that when you hold the prime switch in the primer position with the fuel boost pump on, fuel is flowing through the primer system and into the engine. It is very easy to over-prime an engine with an electric primer, so briefly engage the prime switch.

PRIMING TECHNIQUES

Priming techniques vary among aircraft; therefore, it is important to determine the best method for the plane that you fly regularly. The engine may not necessarily require priming on every start, depending on the ambient temperature and the engine temperature. Try starting the engine without priming on a warm day or with a warm engine. You may find that the engine starts just fine. There is no set rule, such as "always give it two shots of prime." Experiment with different techniques to see what works best for your airplane. [Editor's Note: But always check your aircraft's operating handbook or flight manual first.] Remember that the less fuel you have to introduce to get the engine started, the better.

One technique that often works well with both manual and electric systems is to engage the starter and allow the engine to rotate a few times before priming. This allows air to flow into the engine so that, when primer fuel is introduced, it will mix with the incoming air. With a manual primer, pull the primer out, engage the starter, and slowly push the primer in while the engine is cranking. With an electric primer, turn the boost pump on, engage the starter, and then turn on the electric primer for a few seconds. Introducing the fuel into an air stream, rather than into a static engine, greatly improves the effect of priming. It also reduces the possibility of over-priming, which can flood the engine and lead to an induction fire.

PRIMING WITH THE THROTTLE

Some pilots—even CFI's—say that they pump the throttle a few times when starting a stubborn, cold engine. This is not a recommended practice because aircraft engines generally have up-draft or horizontal-draft induction systems. This means that air and fuel must flow upward or horizontally through the carburetor and the induction tubes on their way to the cylinders. If the fuel is not completely picked up by the air and taken into the cylinders, it will drain away from the cylinders and back into the induction system, where the fuel then may form puddles of raw fuel.

The fuel is especially likely to "drop out" or fail to mix with the air stream if the fuel is introduced in a coarse, heavy spray rather than a fine, atomized mist. To illustrate this concept, change the nozzle setting on a spray window cleaner bottle from "spray" to "stream." Squirt some on a window. Notice that when it hits the glass it promptly runs down the window. But with the nozzle set in the "spray" setting, the cleaner is dispersed in a fine mist and does not run off as easily.

The fuel that is discharged from the acceleration system of the carburetor when the throttle is pumped is a coarse, heavy stream—not a fine mist. It is very likely to run down the inside of the induction tubes and form puddles. The primer nozzles are so important because they atomize the fuel. It is possible to form puddles even when using the primer system, so do not over-prime. If you do create puddles of fuel in the induction system and the engine backfires during starting, the fuel can ignite or even explode. This is called an induction system fire and can result in serious injury or damage. Even if you've had success "priming" with the throttle, it's only a matter of time until an induction system fire occurs and spoils your whole day.

Don't be afraid to try different priming techniques to discover what works best for your airplane. Just remember that there are only two universal rules for priming: Less is best and do not attempt to prime the engine with the throttle. ✈

The author, an Assistant Professor, School of Aviation Sciences, teaches aircraft systems courses at Western Michigan University.

SAY AGAIN... by Michael G. Rodriguez

FIRST AIRCRAFT SAVE

Editor's note: Mr. Rodriguez is currently a FAA Air Traffic Controller at the Roswell, NM, Air Traffic Control Tower. His humor refreshes our tumultuous world with just a little pinch. So, we decided to share it with you!

CALCULATED FLIGHTS OF FANCY

by Bill Belanger

Joe had planned carefully his first solo cross-country flight. It was an easy 50-mile trip. He had calculated his heading and estimated time in flight to account for the wind at 3,000 feet. He had drawn a straight line on his sectional chart to show the course he intended to fly. However, when I reviewed his preflight planning, something didn't seem quite right. Joe's proposed heading was about 30° to the left of the course he intended to fly. Fortunately, the mistake was caught before he departed.

Joe's mistake in the heading was a simple mathematical error, and it was corrected easily. But there was also an underlying problem that had to be addressed. Why wasn't it obvious to Joe that his heading was so far off? Joe needed something more than the rote "book knowledge" he had learned. He needed a simple rule of thumb to tell him whether his calculations were at least in the right ballpark.

As pilots, we are required to be able to calculate accurately fuel use, runway requirements, headings to be flown, and a host of other information. But do we tend to put too much credence in the accuracy of those pre-takeoff calculations? As students, we are taught how to calculate a heading to be flown and the crosswind component for landing. But we are rarely taught the limitations of these calculations or how to do a simple "reality check." We are taught to use the information in the Pilot's Operating Handbook (POH) to determine the performance of our airplane. In fact, pilots are usually taught to treat the information in the POH as absolute truth.

And what about those in-flight calculations? Suppose you arrive over a checkpoint later than you expected because of an unforecast winds? Or that wind sock extending out directly across the runway suggests that the forecast light wind right down the runway may be just a bit off? Or you have to divert to another airport because of weather or for some other reason no one ever admits to (like a detour to locate and admire the scenery)? That makes all those careful pre-takeoff calculations less useful.

This article offers some simple techniques to tell you if your preflight calculations on your "Dandy Digital Flightplanner" are close to the mark or can be used as a rough cut in a pinch. It also discusses some of the limitations of information in the POH and how to account for these limitations in pre-flight planning. Most importantly, it discusses how to use your knowledge of the uncertainties in the calculations to assure a safe flight.

FUEL ENDURANCE

This is one of the easiest calculations to make before takeoff, but fuel mismanagement is still a major source of accidents. All you have to do is multiply gallons per hour times the hours in flight, allowing for taxi, runup, and climb. But if it's really so easy, why are there so many accidents because of fuel exhaustion? Maybe there's more to it than meets the eye.

The POH gives the fuel endurance of the airplane, usually at three power settings: 75%, 65%, and 55%. For example, a Cessna 152 has an endurance (with reserves) of a little over three hours at 75% power, a little over three and a half hours at 65% power, and about four and a half hours at 55% power. But how dependable are these POH numbers? Are you willing to bet your life on them?

The POH performance figures are for a new airplane in perfect condition and perfectly leaned for minimum fuel consumption. Is this a description of the airplane you fly? Any change from these conditions makes the engine use more fuel. So, if your engine isn't in perfect shape and you don't lean it properly, the POH could be an optimistic estimate of your endurance. To add to the uncertainty, can you really be sure you started the flight with full tanks? Most airplanes have wide, flat tanks. If the airplane is even a little tilted to one side, the tanks may appear full, yet be a few gallons short. And even if the tanks were full the night before, if you park the airplane with one wing low, fuel may drain out the vent. This might make the POH endurance figures very optimistic indeed! It only takes three gallons of extra fuel burn (about a 15% increase), or three gallons of fuel not on board in the first place, to eat up a half-hour reserve in a Cessna 152.

Fuel consumption is given by the POH for a specific power setting. Most pilots want to go fast, so they try to fly at 75% power. But what is 75% power? There's no gauge on the panel of most light airplanes that directly shows the percent of engine power. There's only the tachometer and perhaps a manifold pressure gauge for injected engines. So what RPM and manifold pressure do you set to get 75% power? This depends on the density altitude. In a Cessna 152, 75% power is 2,400 RPM at 2,000 feet pressure altitude with standard temperature. Fly the same airplane at 8,000 feet pressure altitude and standard temperature, and 75% power is now 2,550 RPM. If you are like most Cessna 152 pilots, you set the RPM at 2,400, regardless of altitude. At 8,000 feet this yields 64% power. Well, at least this puts the error in the right direction, but you'll find yourself flying a little slower than you expected.

The whole point here is that your careful fuel burn calculations are only as good as the condition of the engine, the skill of the pilot, and the actual amount of usable fuel on board, rather than the size of the tanks. Those four places after the decimal point on your "Dandy Digital Flightplanner" are about as meaningful as the fuel gauges on typical light airplanes, which is not very meaningful at all. Worst of all, many of the likely errors are in the wrong direction. They cut into your fuel reserve. Therefore, you need to know your particular airplane as you fly it and perhaps carry an extra reserve above the legal minimum.

Knowing the airplane means keeping a record of your fuel consumption under various conditions. For example, you should keep a record of fuel consumption whenever you make a long flight. Use this fuel consumption in your preflight calculations in addition to the POH numbers. Believe whichever is the most pessimistic. Keeping track of fuel consumption has an extra benefit. If there is a sudden change or a wide discrepancy from the POH numbers, it can alert you to trouble before it bites you.

Many experienced pilots refuse to fly with less than an hour of fuel reserve. This may have something to do with why they eventually become experienced pilots. This extra margin over the legally required reserve (30 minutes VFR, 45 minutes IFR and night VFR) provides a much needed safety margin. It's not only a good idea in case you can't land where and when you planned, but it also accounts for the limitations of the fuel endurance calculations.

TO LAND OR NOT TO LAND

So, there you are at 6,500 feet, and the last checkpoint was about a quarter-hour late in coming. How do you calculate whether you have enough fuel to complete the flight? The first thing you need to do is to think "in hours," rather than "gallons." If you are about halfway into the flight and the checkpoint was about 15 minutes late, you can probably expect the whole flight to be about a half-hour longer than you planned. If you are only a third of the way into the flight, then expect an extra three-quarters of an hour to be tacked on to the time in the air. In other words, whatever fraction of the flight has passed must be scaled up to reflect the whole flight. The earlier you are in the flight, the greater will be the effect on the total time. This assumes that whatever affected the first leg also will affect subsequent legs, which is probably true if you fly in the same direction during the entire flight.

Do not attempt to do calculations of fuel endurance to the nearest minute in flight. It will just distract you from your main job—flying the airplane. (You should do this on the ground before the flight.) Go for a good mental approximation, something you can visualize easily. The calculation is only as good as your knowledge of your actual fuel burn and what was in the tanks when you started, so there's no need to be within an ounce. What you want to find out is whether you still have enough fuel to make the planned destination with reserves or if a change in strategy is needed. As soon as it looks like the fuel reserve will last less than an hour, it's time to go to "Plan B." Even if you have only mentally calculated to the nearest quarter-hour, this will still assure that you have at least a 45-minute IFR or night-VFR reserve, assuming you started with full tanks. And don't think of the reserve as extra time available for flight. Think of it as insurance in case the tanks weren't full.

CROSSWIND COMPONENT ON LANDING

Every pilot is required to know the demonstrated landing crosswind component of his or her airplane. And there's a nice little chart in the POH that lets you determine the crosswind component at any wind speed and any wind angle from the runway heading. Now let's throw in that unforecast wind. Did you ever try to use this crosswind component chart while airborne, especially while preparing to land? And when you get to your intended landing site, you may not know the wind speed, unless there is on-airport data. There has to be a better way.

As with fuel consumption, there are some things to consider about the accuracy needed in this calculation. The demonstrated landing crosswind component in the POH is exactly that. It is a test pilot's estimate of how much crosswind can be handled in the airplane by a pilot of average skill. It is a number that includes a judgement of pilot skill, as well as airplane characteristics. So the most obvious question is whether or not your skills are average. Let's admit we're average just to be on the safe side. How well do you really know the wind? If it is gusting or variable, the calculation of crosswind component may have little meaning. So let's explore how to be safe even though we really don't have perfect numbers.

There is a relatively simple rule of thumb that can be used to get a rough idea of the crosswind component, once you know the wind speed and direction. To do this, you only have to remember three numbers: 30, 45, and 60. If the wind is 30° off the runway heading, then the crosswind component will be half the wind speed; at 45° it will be about two-thirds of the wind speed; at 60° the crosswind component is almost nine-tenths of the wind speed. To handle the angles in between, use a simple proportion for angles less than 30°. For example, at 15° off the runway heading, the crosswind component is about half the value at 30°, and this makes for about one quarter of the wind speed. Between 30° and 45°, use the value for 45°, or two-thirds of the wind speed. Above 45° but below 60°, use nine-tenths of the wind speed. Above 60°, use the full wind speed.

Once you have calculated this ballpark number, ask yourself if you're dealing with an obviously unsafe condition. If so, head to a location where the runway points into the wind. But if your best estimate of the crosswind seems reasonable and doable, begin a stabilized wing-low approach. If you can hold the airplane on the centerline and, with the rudder, you can keep it aligned with the runway, you can probably make the landing. Remember that the wind speed normally decreases with altitude. However, as your speed slows, rudder effectiveness will decrease. This may dictate a higher touchdown speed. Just remember that if there is any doubt or if

you begin to run out of rudder, go around immediately. And remember to apply that aileron into the wind after you land.

CRAB ANGLE

One of the three basic navigational methods is dead reckoning. Every student learns how to calculate the heading based on the forecast winds aloft. The heading calculation will be done by most students to within a degree, despite the fact that heading can be maintained only within about 5° or 10° by most pilots when flying by hand. And the forecast wind aloft is exactly that—a forecast. It can be several hours old by the time of the flight. During the flight, winds aloft may be different from the forecast. With gyro precession and potential magnetic compass errors, the heading may be a few degrees off. So why calculate it so exactly? And how can you spot a mathematical error or a botched keystroke in the "Dandy Digital Flightplanner?" What you need is a rough cut at the crab angle.

First, let's look at a simple rule of thumb that allows us to estimate the effect of the errors involved. A one-degree course error results in a one-mile error at a distance of 60 miles. Keep this in mind because it's useful for a lot of things.

Let's suppose you are flying with visible ground references. If you made a nine-degree heading error and your ground reference is 20 miles away (one-third of 60), you won't miss it by more than three miles (nine divided by three). With reasonable VMC visibility this is not a problem. In fact, the practical test standards require a pilot to fly within 10° of heading and remain within three miles of the intended ground track. This suggests how far apart your ground references should be when navigating by pilotage.

Now suppose you find yourself about one mile to the left of your ground reference, and you have flown about 20 miles to get to it. You will need to adjust your heading about three degrees to the right to fly parallel to your intended course. Since you are now to the left of your intended flight path, doubling this correction will bring you back in about 20 more miles. If your ground references are about equal distances apart, then doubling the correction will bring you back on centerline when you get to the next ground reference.

This takes care of the navigation problem when there are ground references, but what about that rough cut at the heading for the flight planning? There's another way to use this 60 mile/one degree relationship. Let's divide the distances by hours, which translates everything into knots. Now, at a speed of 60 knots, a one-degree heading error translates into a one-knot speed perpendicular to the course. At higher speeds, the angles required are proportionally smaller. At 120 knots, one degree of heading error translates into a two-knot crosswind component. This is just the 60-mile rule scaled up to 120.

Now let's use this error to compensate for a crosswind. From the "one in 60" rule, if an airplane is flying at 60 knots, a 20-knot crosswind would require a crab angle of 20° (one degree per knot). At 90 knots, you would need a 15° crab angle. These are all simple proportions drawn from our basic rule of thumb. We already know how to estimate the crosswind component. These rules allow you to make a rough approximation of crab angle to check your calculations.

This method also works in reverse. If you know the crab angle needed to stay on course, you can use it to estimate the crosswind component. If you fly at 60 knots with the ball centered, one degree of crab will equal one knot of crosswind. At 90 knots, one degree of crab will equal one and a half knots of crosswind. At 120 knots, it will equal two knots of crosswind.

Now what about that landing at the remote strip with no weather observations and a torn windsock? All you have to do is fly the runway centerline, and you can get an estimate of the crosswind. If you fly the runway at 60 knots, one degree of crab from the runway heading equals one knot of crosswind. If you fly the centerline at 90 knots, one degree of crab equals one and a half knots of crosswind. As an example of this technique, suppose you are flying a Piper *Archer* along the runway centerline in coordinated flight at 90 knots. If this requires a 10° crab, the crosswind is 15 knots, which is less than the "demonstrated crosswind component" in that airplane, and you can probably land. If you need a 20° crab, the crosswind is about 30 knots and you better take your business elsewhere.

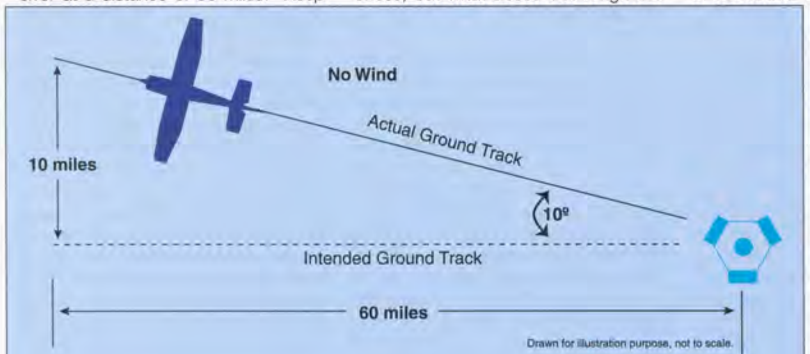

Figure 1 • *For every degree of heading "error," at 60 miles distance, there will be a one mile position "error." Therefore, if you are 10 degrees off course at 60 miles, you will be 10 miles off course. The error is proportional to the heading error and the distance.*

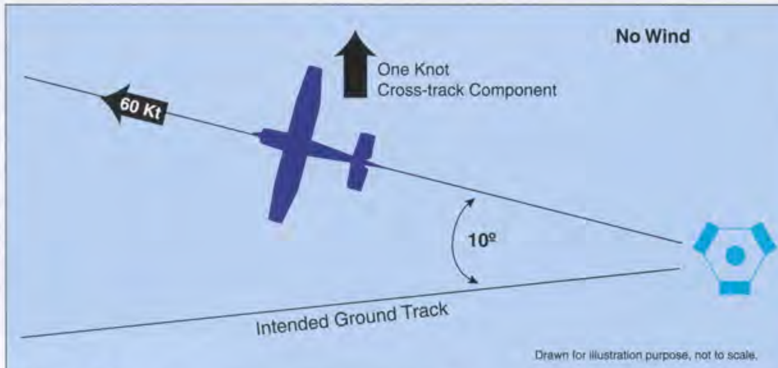

Figure 2 • *Divide distance by time and you get speed. Thus, at 60 knots airspeed, a one degree cross-track angle will produce a one knot cross-track speed. A ten degree heading "error" at 60 knots will produce a 10 knot cross-track speed. At 90 knots, the result of a ten degree heading "error" would be a 15 knot cross-track speed. Now the cross-track speed is proportional to speed and angle.*

TAKEOFF AND LANDING RUNWAY REQUIREMENTS

This is another case where the POH may be quite optimistic. Takeoff and landing distances are given for an airplane in perfect condition with perfect pilot technique. If your engine is not producing full power because it's nearing the end of its career, your airplane will not deliver performance according to the book. If your technique is less than perfect, you can expect to be on the ground a bit longer. If the density altitude is high and you forget to lean your normally aspirated engine, you can expect a long takeoff run. In the POH for a Cessna 152, Cessna bases its performance figures on a mixture leaned to maximum RPM above 3,000 feet. The POH probably will not give a takeoff distance for under-inflated tires, but it will be longer.

A runway that slopes up will add considerably to the takeoff run. It is a good idea to treat the POH figures as optimistic estimates of your airplane's performance.

So you carry an extra fuel reserve for safety. Maybe it would be a good idea to set your own personal runway requirement rather than blindly using the POH performance data. So what is a practical personal runway length? How might it be calculated and are there any shortcuts? Let's assume that if you land at an airport, you will want to take off later. Which is longer for your airplane—the takeoff run or the landing roll? For many light planes, it's the takeoff run. Also, as density altitude increases, the takeoff run is affected more than the landing roll. Using the Cessna 152 as an example, its landing roll at sea level, 0°C., is 450

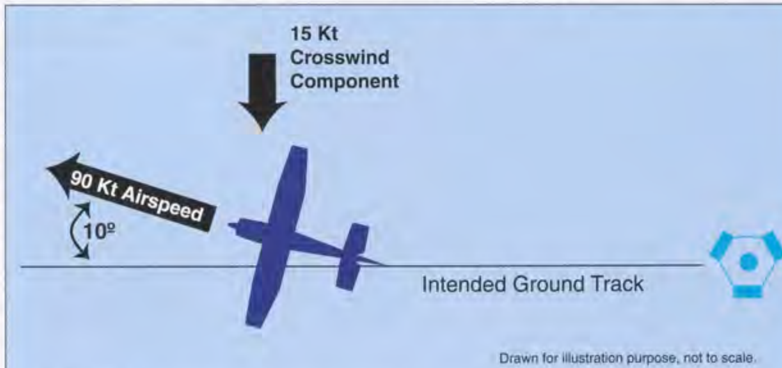

Figure 3 • *The heading "error" becomes a crab if it is used to maintain a ground track against a crosswind. In this case, a 90 knot speed results in a 15 knot cross-track speed with a 10 degree heading "error." If the crosswind is 15 knots, the intended ground track will be flown. The required heading correction is proportional to the crosswind component and inversely proportional to airspeed.*

feet. At 8,000 feet and 0ºC this increases to 605 feet, a 35% increase. The landing distance over a 50-foot obstacle increases by only 18%. The landing distance increase is mainly because of the higher true airspeed in the thinner air at altitude.

Now look at the takeoff distance. The ground roll at sea level and 0ºC. is 640 feet. At 8,000 feet and 0ºC, that has increased to 1,405 feet, an increase of 116%. The obstacle clearance distance has increased 135%. This happens because you not only need to reach a higher true airspeed, but you also have a less powerful engine and a less efficient propeller in the thinner air. In other words, if your takeoff run is longer than the landing roll at sea level, it will be longer than the landing roll at any higher density altitude. Once you establish the altitude where your airplane's takeoff performance is limiting, at any higher altitude you can safely determine your landing requirement by knowing your takeoff performance. This is like two calculations for the price of one. But remember that a lightly loaded airplane lands long unless airspeeds are reduced to compensate for the lower stall speed.

Now, what about that takeoff performance? How long a runway do you really need? This is where the POH is only the first approximation. You also have to factor in your skills and your airplane, including your personal preference for how safe you want to be. FAR Part 91 does not require balanced-field operation, but let's imagine you need to abort the takeoff just before rotation. Will you have room to stop? Again, using our Cessna 152 as an example, at sea level, 0ºC, the POH says the short-field takeoff ground run is 640 feet. If you're a normal pilot flying a typical vintage Cessna 152, your ground run could be more like 1,000 feet. If you decide to abort the takeoff just before (or after) rotation speed, you will be above touchdown speed for a normal landing, and flaps will be set at no more than 10º. Now, you can expect a braking distance somewhat in excess—and maybe double—the POH landing roll figures. You might want to establish a personal minimum of about 2,000 feet of runway for a Cessna 152 at sea level on a cold day! This is greater than the (optimistic) 1,190-foot obstacle clearance distance given in the POH.

On a typical summer day of 30ºC. (about 85ºF), the POH says a Cessna 152 wants a 1,795-foot ground roll and requires 3,765 feet to clear a 50-foot obstacle. For a typical pilot and airplane, let's say the ground roll might be more like 2,500 feet. If the takeoff is aborted at rotation, the stopping distance will be somewhat greater than the POH landing roll of 675 feet. Let's call it 1,000 feet. In other words, you might want about 3,500 feet of runway. This compares favorably with the 3,765-foot obstacle clearance distance given in the POH, though the philosophy is different. Prudence would suggest using the larger of the two numbers. To set your personal runway requirement, do that little exercise for your own airplane at sea level and at a density altitude of 8,000 feet.

One of the most important messages here is that you and your airplane might not be able to match the performance figures in the POH. So why not find out what your personal numbers are in the airplane you fly? Bring along a friend to take the measurements and load the airplane near gross. Now use the runway markings to measure your takeoff run under various conditions. The results might be surprising. The most instructive test will be to abort at rotation speed and see how much runway you need to accelerate and stop. Do this test on a long runway. It's a safe bet the numbers will be longer than the POH suggests, and longer than you expected. Use these personal numbers as a part of your flight planning. They will tell you just how optimistic the POH can be.

THE BOTTOM LINE

In financial matters, the bottom line is a big number that is produced by adding and subtracting a bunch of little numbers. Most investors are skeptical of that bottom line. They look at what goes into it before they invest. Similarly, a pilot should account for the uncertainties in the factors that make up the bottom line on airplane performance, navigation calculations, and that "place" where the two meet. The investment is a human life.

Happy calculating!

The author is a flight instructor who spent six months at the FAA's Technical Center doing human factors research.

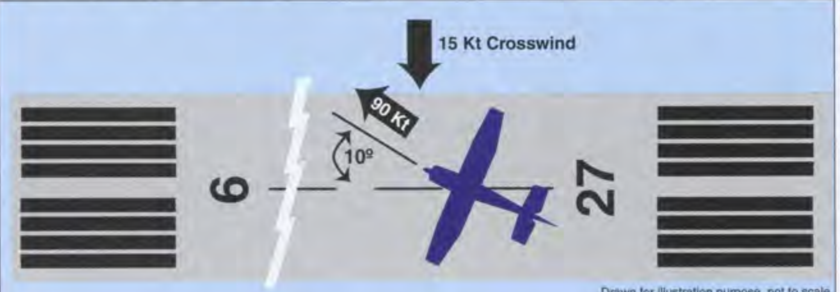

Figure 4 • *Fly along the runway at 90 knots and note the crab angle. A 10 degrees crab angle at 90 knots indicates approximately a 15 knot crosswind. In this case the required crab angle can be used to estimate the crosswind component.*

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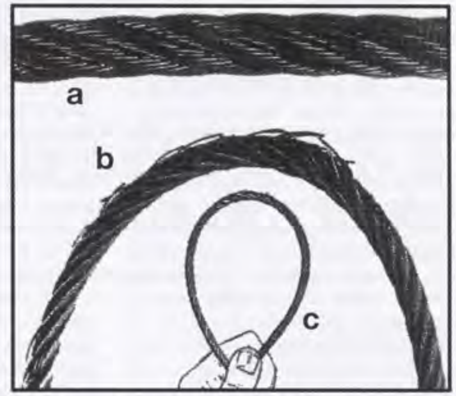


Figure 1: Cable inspection technique

The Civil Aviation Authority (CAA) of New Zealand's safety publication VECTOR published a detailed article on aircraft control cables after several defect reports involving cables were reported to the CAA. After reading the article, we thought American general aviation (GA) pilots would benefit from a similar article since many GA pilots are starting to kick the tires and pull bird nests out of their trusty aircraft in preparation for another season of flying.

We will limit our review of control systems to the two primary ones found on most small GA aircraft. The traditional system—flexible steel cable—dates back to the beginning of powered flight. Such systems use steel or stainless steel cables to connect the aircraft's stick or yoke or pedals to the ailerons, elevators, and rudder—the aircraft's primary flight control surfaces. The second control system uses rigid push/pull tubes or rods to connect the stick or yoke or pedals to the primary flight controls. Each system has its advantages and disadvantages. It is important that pilots understand the system in their respective aircraft and how to preflight it properly.

STEEL CABLES

Steel cables offer many advantages for flight control systems. They are time-proven, simple, inexpensive, and light-weight. In those aircraft where power-assisted flight controls are not needed, steel cables give the aircraft designer flexibility in laying out the routing of the cables between the cockpit and the control surfaces. Normally made up of a number of smaller strands of flexible steel wire, cables can be designed to handle the flight loads of both small and large aircraft. By increasing the number of strands of wire, the diameter or size of those strands, and the type of wire used, engineers can adjust both the strength and flexibility of any type of cable. For operating environments subject to corrosion, such as seaplane operations on saltwater, stainless steel cables may be installed. Because of the important role flight control cables play in the safe operation of an aircraft, pilots and especially aviation maintenance technicians (AMT) need to ensure that the installed cables in an aircraft are properly routed, are of the correct type, are not damaged, and have the proper amount of tension to operate properly. Proper tensioning is important because steel cables can contract or elongate with changes in temperature with the result that the cable tension can change.

In aviation, pilots depend upon their aviation maintenance technicians to ensure the continued airworthiness of their aircraft. This trust includes ensuring that the proper and airworthy control cables are installed in the pilot's aircraft, including those cables not readily visible. Pilots also trust their AMT's to inspect the complete cable system during required maintenance inspections for excessive wear and to ensure continued airworthiness of the system. Although pilots depend upon their AMT's to a great degree, pilots have the day to day responsibility of ensuring their aircraft are airworthy before each flight. This preflight assessment includes the control system.

Consequently, pilots need to know how to check their respective control systems both during the preflight and as part of their pretakeoff cockpit checks. Having said that, the most important control check any pilot can do in any aircraft with any type of control system is to ensure complete control freedom of movement in all appropriate directions and that the controls operate in the proper directions. More than one flight has ended in disaster when the aircraft took off with one or more of the flight control surfaces jammed or with a gust locked still installed or with the controls rigged backwards. These critical checks are especially important anytime the control system has been worked on by anyone or the pilot is in a hurry or more than one person does the preflight.

As part of the preflight check of the cable system, pilots need to inspect visually all exposed portions of their cables for broken wires, excessive wear, and corrosion. One way to check for broken wires is to wipe the cable with a clean rag. Broken wire strands normally will snag the rag. Although this is not a foolproof method to detect all broken wires, it is one way to check the exterior surface of a cable. Anyone using this method must protect their hands because broken cable strands can cut hands severely. This method cannot detect broken wires inside a cable, however.

Interior broken wires require a careful visual inspection of the cable. In many cases, it is difficult to detect broken interior wire strands without bending the cable to force the strands apart. One way to isolate broken interior strands is to look for signs of excessive wear on the exterior then check for damaged interior strands.

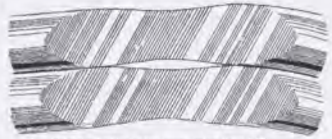
Wherever a cable changes direction, such as around a pulley, or wherever a cable can rub against another part of the aircraft, that area of the cable needs to be checked very carefully for excessive wear. The pulley or guide also needs to be checked for excessive wear.

Finally, if visible, the cable attachment points in the cockpit and at the control surfaces need to be checked for excessive wear and security. The mounting hardware also needs to be checked because these points bear the brunt of the control input forces. Bolts, nuts, washers, and proper safetying all need to be inspected for security and proper attachment.

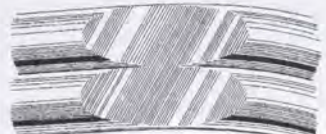
PUSH/PULL TUBES

Being rigid, push/pull tube- or rod-equipped aircraft don't have the same type of "feel" that a cable-equipped aircraft has. Made of either hollow metal tubes or solid rods, such systems have some of the inspection problems of their older, cable-equipped counterpart aircraft. Pilots must still check their flight control systems for freedom of movement and full motion. Pilots must check any visible part of the push/pull control system for corrosion damage, for any visible sign of excess wear on the attachment hardware, bearings, and bushings, and for any sign of excessive stress, damage, or play to the push/pull tube or rod. Proper lubrication becomes even more important at the attachment points and mounting hardware of push/pull tubes. Since bearings are commonly used at attachment points, they should be cleaned and lubricated as per the aircraft's manuals. Bolts, nuts, washers, and proper safetying all need to be inspected for security and proper attachment.

Because some control tubes are hollow, the possibility of internal corrosion can become an issue. Anyone inspecting or working on such systems should pay close attention to the appropriate maintenance manuals to make sure all required inspections and checks are done and done properly.



▲ Individual outer wires worn more than 50%



▲ Individual outer wires worn 40-50% (Note blending of worn areas)

▲ Individual outer wires worn less than 40% (Worn areas individually distinguishable)

CONCLUSION

Regardless of what type of aircraft you fly or maintain, to ensure the safe operation and continued airworthiness of that aircraft, you as the pilot in command or AMT responsible for the maintenance of that aircraft need to follow and comply with the aircraft manufacturer's pilot operating handbook, approved flight manual, operating manual, or appropriate maintenance manuals and changes respectively.

Although we have been reviewing some of the unique characteristics of cable and pushrod control systems, we also want to remind pilots and maintenance technicians to carefully check all of the control surfaces that these systems operate. Loose rivets, missing screws, and wrinkled or damaged skin are all examples of the types of damage you should look for when inspecting the control surface attachment areas. Another important area to check is the control surface trim tab and its attachment point. A good check for all trim tabs and flaps is to set them to the zero position and check to see if they are properly aligned with the primary control surface, or in the case of the flaps, are they aligned with the trailing edge of the wing. Then set the control to a designated position, and check if the trim tab or flap moves in the correct direction and in the correct amount of deflection. Some surfaces may not always "zero" out because of required offsets to counteract other design forces. This is why all control surfaces need to be adjusted and aligned in accordance with the aircraft's maintenance manuals.

We hope this short article on control systems has increased your interest in the subject. Your aircraft operating handbook and maintenance manuals contain detailed information on your aircraft's control operating system. You should check them out. You may be glad you did.

Have another safe year of flying.

We wish to thank the CAA of New Zealand and VECTOR Editor Cliff Jenks for permission to use some of the material and ideas from its safety magazine, VECTOR, in this article.

LASER LIGHT EXPOSURE

What is Being Done to Protect Pilots and Aviation Safety?

by Van B. Nakagawara, OD, and Ronald W. Montgomery

When we think about lasers (i.e., Light Amplification by Stimulated Emission of Radiation), we often remember old television heroes, like Buck Rogers and Flash Gordon. More recently, science fiction movies, such as the "Star Wars" and "Star Trek" series, have reinforced those stereotypes. In reality, lasers are sophisticated instruments that emit light beams that are so powerful they can cut through metal or so delicate they can perform microscopic surgery.

Outdoor laser light displays have become increasingly popular over the past few years. In theme parks and in areas where legalized gambling have resulted in large, elaborate casinos (Nevada and Mississippi, for example), laser light shows have flourished in attempts to entertain and attract customers. More recently, special events, such as the NCAA Basketball Final Four Championship, have used laser light displays to advertise and glamorize these attractions.

The penetration of laser light into navigable airspace has resulted in temporary visual incapacitation of pilots. Laser light illumination can be similar to being exposed to a camera's flash bulb without warning. Besides momentary shock and surprise, effects can include glare, afterimage, and flash-blindness.

Glare is the dazzling sensation of a bright light that produces discomfort or interferes with optimal vision. Afterimage is a persistent sensation or image perceived after the causal physical stimulus has been removed. Flash-blindness is visual loss following exposure to a high intensity flash of light. Afterimages and flash-blindness can last for several minutes. The illumination level for these effects can only be estimated, as individual differences to non-laser light exposure are well documented in clinical practice. Additionally, there are little data on how startle affects the pilot, and the intensity of the illumination, for this may be quite low.

Documented incidents of laser light affecting pilots include:

- *July 1997.* A B-737 on approach to Ontario, CA is at 5,000 feet and about five miles from the approach end of the runway. The pilot notices a red laser light sweeping back and forth in the cockpit. It oscillates four to five times then disappears. About four to five seconds later, the same sequence occurs and appears to track the aircraft.
- *November 1996.* An EMB-120ER was on a visual approach to LAX when a blue laser light struck the captain's right eye. As he continued the flight, his ability to see became difficult because of burning in his eye and tearing. The captain had to relinquish the controls to the first officer (FO) who landed the airplane without incident. A medical examination revealed that the captain had suffered multiple flash burns to his right cornea.
- *October 1995.* The FO on a 737 departing McCarran Airport in Las Vegas is struck in the right eye by a laser light at about 7,000 feet. Unable to see or focus for well over two minutes, the FO is forced to turn over control of the aircraft to the captain.
- *June 1994.* A flight engineer on a U.S. Air Force EC-130E is flashed by a laser light from a casino in Biloxi, MS. The crewmember is momentarily blinded, unable to read his instruments. Post-event symptoms temporarily restrict the airman from flight duty.
- *November 1993.* A laser beam through the right side cockpit window struck the right eye of the FO of an airliner departing Las Vegas. Both the captain and the FO are blinded for five to 10 seconds, and the FO's night vision is reduced for five to 10 minutes. The FO later experiences a conjunctival irritation in the right eye.
- *June 1990.* A pilot of a wide-body aircraft on approach to Miami reports a green laser light flashed directly into his eyes, blinding him for about two seconds and resulting in problems with focus and irritation for two minutes longer. The beam was from a laser light show being performed at the edge of the downtown harbor area.

As the number of laser installations has increased (It is estimated that about 200 operators have licenses for laser shows.), so has the number of reported laser strikes to aircraft. Over 50 laser-related encounters by flight crews were reported to the McCarran control tower in Las Vegas over a two-year period. A potentially serious condition exists when the laser flash wipes out the dark adaptive state of the pilot. Partial recovery of dark adaptation is normally achieved in three to five minutes, but full adaptation typically requires 40 to 45 minutes. During this period, the pilot would be visually compromised, making night flight operations difficult or impossible.

As a result, the Food and Drug Administration (FDA) established a moratorium on outdoor laser shows in the Las Vegas area because of the number and severity of some reported incidents. Laser operators argue that their control measures are adequate to prevent exposure of aircraft at hazardous levels.

The adverse effects of laser light exposure on the proper execution of critical flight operations have caught the attention of the aviation community. The Society of Automotive Engineers (SAE) G-10 (Aerospace Behavioral Engineering Technology) Committee has held several meetings to investigate this problem. The SAE G-10 Committee is working with FAA and FDA in investigating aviation issues, reviewing regulations, and recommending changes to solve or minimize identified problems whenever possible. Laser hazard safety meetings have included representatives from the Air Line Pilots Association, U.S. Air Force, and FAA, as well as other technical experts.

Among other activities, the SAE G-10 Laser Hazards Safety Subcommittee is working with FAA, FDA, and other concerned groups to rewrite FAA Order 7400.2D, Chapter 34 (Outdoor Laser Demonstrations), which regulates outdoor laser demonstrations used for entertainment and promotional purposes. Currently, the operator/manufacturer must first apply for permission to project higher power lasers in navigable airspace from the FDA's Center for Devices and Radiological Health and obtain what is known as a "variance." Both the FDA variance and FAA Order 7400.2D require the laser operator/manufacturer to notify the FAA of the planned laser demonstration. Upon notification, an aeronautical study is conducted by the FAA's Air Traffic Division in the region where the laser installation is being planned. The study determines the laser demonstration's potential effect on air traffic in the immediate area. Once the FAA and all FDA requirements are met, the operator/manufacturer is then permitted to project laser beams into navigable airspace in a controlled and responsible manner.

FAA Order 7400.2D is written in terms of the FDA's "Performance Standards for Light-Emitting Products," 21 Code of Federal Regulations (CFR) 1040. The FDA standard is based on the recommended Maximum Permissible Exposure (MPE) of 2.6 mW/cm^2 for continuous wave lasers that establishes the Nominal Ocular Hazard Distance within which biological damage may occur. This MPE was established by the American National Standard for Safe Use of Lasers (ANSI Z-136.1-1993). However, this standard does not protect aircrew members from temporary visual incapacitation.

The revised FAA Order 7400.2D identifies interim guidelines for new exposure limits to specific zones of navigable airspace around airports. These include the original MPE covering all uncontrolled airspace and additional restrictive exposure limits covering "sensitive" and "critical" flight zones around airport runways. A "laser-free" flight zone is also specified for final approach and take-off corridors. The SAE G-10 Laser Safety Hazards Subcommittee has recommended that research be performed to ensure that the new interim guidelines are appropriate. In addition, the SAE considers communication between laser users, the FAA, and pilots, as well as specialized technical training for these groups, to be important steps in minimizing and/or eliminating this problem.

The FAA's Airspace and Obstructions Evaluation Branch only required Notices to Airmen (NOTAM) to be disseminated locally for new laser installations in the vicinity of an airport. In an effort to be proactive on this issue, laser NOTAM's are now issued through the National Flight Data Center and sent throughout the country. The texts of these NOTAM's include information regarding the proximity of a laser to an airport or navigational aid, location of light source and direction of beam, and a special notice or warning concerning the possibility of flash-blindness.

In summary, commercial laser light shows are used to attract and/or entertain customers at theme parks, casinos, and special events. Although exposures to these laser beams are normally at levels that would not cause biological damage, adverse effects to vision can occur and have been reported. Revision of regulations concerning the operation of laser shows in navigable airspace is currently in progress to ensure aviation safety is not compromised. Research to validate new guidelines for exposure to outdoor lasers of the civilian and military pilot population is ongoing. ✢

Dr. Nakagawara is the Research Optometrist at the FAA's Civil Aeromedical Institute (CAMI). He has been actively involved with the SAE G-10 Laser Safety Hazards Subcommittee almost since its inception. Mr. Montgomery is a Vision Research Specialist on CAMI's Vision Research Team. They are currently involved in a research study, using the FAA's B-727-200 flight simulator, that will evaluate the effect of low-level laser light exposure on pilots during terminal operations. Results from this research will be used to validate the interim guidelines in FAA Order 7400.2D. This article was reprinted from the Federal Air Surgeon's Medical Bulletin.

THE SAFETY WINDOW — A SIMPLE CONCEPT

by Steven Harms

When we look at aviation accident statistics, we find a very visible relationship between accidents and the airfield environment. By increasing our general awareness of where the majority of aviation accidents occur, we can work to decrease this number. Since this ratio also is similar for the air carrier segment, general aviation pilots should not feel alone when reviewing the statistics.

Within the airfield environment, the following operations occur: preflight, taxi, takeoff, climb, maneuvering, go-around, approach, and landing. Of these operations, landing has by far the highest accident rate because of the high task load and cumulative fatigue factors facing a pilot during this phase of flight. Often our performance is at its worst when we need it to be at its best!

Spurred by our statistical knowledge of airfield environment accidents, we can develop a personal safety concept in which we proactively work to avoid accidents. Let's define the airfield environment and discuss a "safety window" that professional pilots can use to reduce their exposure to accidents.

Visualize a shoe box-shaped object placed over a runway (same concept as the wedding cake shape of class B airspace). When this shoe box is positioned over the runway, each of its sides will be located approximately five statute miles from the runway. The top of the box will extend vertically to 2,000 feet AGL. The exact size of this box is not at issue here, only its concept.

The shoe box represents the airfield environment critical "accident zone." We will have access to and from the airfield environment through an imaginary "safety window," which allows us safe passage into and out of the "accident zone." Keep in mind that our "safety window" may be placed anywhere—often dictated by air traffic control requirements for traffic flow—and will shift as our position changes. Using the "safety window" concept will help keep us mentally aware of the high potential for an accident that may await the unwary pilot operating in the "accident zone."

With safety as our goal, we enter our "safety window" only when we are mentally ahead of—and confidently in control of—the aircraft. If we allow the aircraft to get ahead of us or if a distraction takes over the flight while operating within the "accident zone," we should do our best to fly out of the "accident zone" through our "safety window."

Although this concept requires no special training and is so basic, many pilots do not follow this strategy for avoiding accidents. But when encumbrances start to build, the decision to leave the "accident zone," rather than working out our problems within an area of statistically high accident rates, makes good sense. By choosing "flight" (based on the reactive survival technique of flight or fight), we may avoid becoming the next statistic.

A major flight simulator company adopted this safety concept in a study using advanced simulators. One group of pilots was instructed to land after an induced tail rotor failure was initiated. The other group was instructed to "flight" and sort out their problem at an altitude outside the airfield environment. Once the "flight" pilots had developed their plan of action, they reentered the airfield environment through their "safety window." Most of them regained control and landed safely. However, the majority of pilots who did not leave the area did not experience safe landings.

Consider taking the following actions to ensure safety before and during flight:

- On the ground, do not let external pressures convince you to continue your flight until you work out your problems.
- When problems develop in the air, fly out of the "accident zone" through your "safety window."
- Evaluate your problems using all available internal and external resources.
- Do not allow peer pressure to sway your judgement, coercing you to continue flight within the "accident zone" if you find yourself mentally behind the aircraft, or if a manageable mechanical problem develops which could cause an in-flight distraction.
- Fly back through your "safety window" only when you are convinced you have regained the upper hand, given the particular situation.
- Do not rush yourself; you have both the time and knowledge needed to solve your problems and regain control. Use these resources to your advantage, thereby keeping your passengers—and yourself—out of harm's way.

Once you have completed your flight safely, pat yourself on the back for using excellent judgement.

A little extra time spent outside the "accident zone" may be all that is required to prevent you from being involved in an unnecessary accident. The "safety window" concept can and will prevent accidents. But for it to be effective, pilots must use it every flight.

SO IT'S SEPTEMBER

by Patricia Mattison

It's September. Vacation is over and the kids are back in school. The last relative has returned home, and you finally have some time to yourself. You've been so busy that flying is the last thing you have thought of for a while. Maybe now you can get some time to fly.

Your airplane has been waiting, secure in its tie-down, eager to fly. Three days ago the whole family came out and washed and waxed it to a glossy luster. Now, as you stand there admiring your beautiful airplane, a horrible thought crosses your mind. Your plane may be ready, but you need a flight review!

You are aware that a flight review must be accomplished every two years. FAR § 61.56 requires that you receive at least one hour of ground instruction and one hour of flight instruction to meet the requirements. Two years ago you found a very competent flight instructor with just the right temperament. You two hit it off well, and the flight review was completed without a hitch. You sincerely hope that the same instructor is available for your next flight review.

That same day, anxious to fly, you place a call to the flight instructor, only to find out that the airlines also thought he was special. So much so that they spirited him away with promises of big airplanes to fly. After several days of searching, you hear of another flight instructor who is recommended by a friend who just completed a flight review. "It was a cinch—only took a few minutes," said your friend.

"A few minutes?" you ask.

A few days later you have the honor of meeting that instructor at your airplane. No pre-flight briefing, no ground time. Just off to the very local practice area where you do two stalls, maneuver a steep turn, and make three takeoffs and landings. That was it.

You feel cheated. You know that you have not met the hourly requirement, much less demonstrated the maneuvers required at the discretion of the person giving the test [FAR § 61.56 (a)(2)]. Nothing. Two stalls, a steep turn, and three landings. Ludicrous! It hadn't proved a thing. Money wasted at best. Time lost. But your logbook was signed by the instructor indicating that your flight review was complete.

"Good for another two years," the instructor said with a smile. "But am I?" you ask yourself. Your stalls were a bit sloppy. The steep turn could have been better. The landings were okay, but the instructor never asked you to do short field or soft field procedures. You wonder....

As fate would have it, flying took a back seat awhile longer. The wait was just what was needed. You have time to think. You realize that the only person being cheated was you. You want to be sure you haven't forgotten anything before you take your family in the plane, so you decide to find another instructor and do it right.

Once again the search for the elusive instructor begins. A phone call to a local flight school finally turns up an instructor willing to spend some ground time covering the new regulations, airspace requirements, and weather reporting systems. Your instructor is not shy when it comes to taking the time to clear up any questions you have. After a few hours, you're ready to fly.

The time spent in the air cleaned up the stalls and, after flying for almost an hour, the instructor asks you to return to the field for a series of landings: normal, short, and soft field. When they are completed, you taxi back to your tie down. And you feel much better about your ability as a pilot—competent to handle most of the situations that flying presents you.

Back in the instructor's office you open your logbook to the page of the earlier endorsement. Striking it out with a few strokes of a pen, you then offer the pen to the instructor and say, "I would like you to sign off my flight review, please." The instructor smiles and, taking the pen, writes, "... has satisfactorily completed a flight review on ....," and then signs and dates the endorsement. Now you feel ready to fly.

You've met the requirements this time—really! ✈

Editor's Note: As per FAR § 61.56 (e), a pilot who has completed one or more phases of the WINGS program within the 24 month period does not need to accomplish the Flight Review.

The author is the Safety Program Manager at the Juneau (AK) Flight Standards District Office.

ONE CURE FOR WORKPLACE SAFETY COMPLACENCY: *SAFETY CHECKLISTS*

by Robert A. Feeler

In the U.S., the Occupational Safety and Health Administration (OSHA) is the government agency that promulgates workplace safety regulations and provides oversight to ensure compliance. Its publication, *OSHA Handbook for Small Businesses*, includes some of the strictest and most detailed workplace safety checklists. Many of the items found in these checklists apply to aviation maintenance facilities anywhere in the world.

For instance, some maintenance operations require the use of hazardous chemicals. Every maintenance manager will urge caution in working with hazardous chemicals, and there may be specific rules about how the chemicals are to be stored and used. But the OSHA handbook's checklist for hazardous-chemical exposure safety is extremely thorough. The checklist items go beyond the obvious and include the following:

- Are contents of chemical piping systems clearly marked?
- Where needed for emergency use, are respirators stored in a convenient, clean, and sanitary location?
- If hazardous substances are used in processes, is a medical or biological monitoring system in operation?
- Is ventilation equipment provided for removal of contaminants from such operations as production grinding, buffing, spray painting, and vapor degreasing, and is the ventilation equipment operating properly?

Throughout this article are boxed excerpts from some of the checklists in the *OSHA handbook* that apply to most aircraft maintenance shops: Medical Services and First Aid, Portable Ladders, Portable [Power-operated] Tools and Equipment, Flammable and Combustible Materials, Electrical Cautions, and Exit Doors. *These are not complete checklists for these subjects.* For the full checklists pertaining to these and other subjects, the *OSHA handbook* should be consulted.

Aircraft maintenance shops in the U.S. will derive from the handbook useful knowledge of OSHA regulations and guidelines for ensuring compliance. But sections about the principles of a workplace safety program and guidelines for voluntary safety activity, as well as the checklists, will be useful regardless of what national regulations a maintenance facility operates under. The 57-page booklet includes the following sections:

- A four-point workplace program
- Starting your voluntary activity
- Self-inspection
- Assistance in problem solving

The four-point workplace program is voluntary and is based on safety and health management guidelines issued in 1989 by OSHA. The guidelines represent the agency's [OSHA's] policy on how every work site should protect

MEDICAL SERVICES AND FIRST AID

- ☐ If medical and first-aid facilities are not in proximity to your workplace, is at least one employee on each shift currently qualified to render first aid?
- ☐ Are emergency phone numbers posted?
- ☐ Are first-aid kits easily accessible to each work area, with necessary supplies available, periodically inspected and replenished as needed?
- ☐ Have first-aid supplies been approved by a physician, indicating that they are adequate for a particular area or operation?
- ☐ Are means provided for quick-drenching or flushing of the eyes and body in areas where corrosive liquids or materials are handled?

FLAMMABLE OR COMBUSTIBLE MATERIALS

- ☐ Are all connections on drums and combustible liquid piping vapor and liquid tight?
- ☐ Do storage rooms for flammable and combustible liquids have explosion-proof lights?
- ☐ Are all solvent wastes and flammable liquids kept in fire-resistant, covered containers until they are removed from the work site?
- ☐ Is vacuuming used whenever possible rather than blowing or sweeping combustible dust?
- ☐ Are fuel gas cylinders and oxygen cylinders separated by distance, fire resistant barriers, etc., while in storage?
- ☐ Are fire extinguishers selected and provided for the types of materials in areas where they are to be used?

Class A - ordinary combustible material fires
Class B - flammable liquid, gas, or grease fires
Class C - Energized electrical equipment fires


workers from occupational hazards and reflect experience gained from voluntary protection programs adopted by employers.

Management Commitment and Employee Involvement Required

Management must have a clear commitment to job safety and health. If supervisors and managers do not promote injury and illness prevention, it is unlikely that employees will be motivated to participate fully in prevention programs.

Many companies have found it beneficial to form a joint employee-management safety committee. If the operation is small, consider rotating employees so that each can have an active part in the program. Some actions to be considered are:

- Posting on the employees' bulletin board a company policy/commitment statement about the importance of workplace safety and health issues.
- Holding a meeting with all employees to communicate the policy and discuss its objectives.
- Ensuring that upper management is visible and participates in periodic meetings and reviews inspection and accident/incident reports.
- Setting an example. If safety glasses are required in certain areas, ensure that managers and supervisors comply with the rules.
- Assigning employees to conduct inspections and participate in problem-solving discussions.
- Making safety and health responsibilities a part of everyone's job description.
- Providing on-the-clock time and resources for those with specific responsibilities to perform their duties under the safety and health program.
- Providing recognition and reward for those who do outstanding work and corrective counseling for those who fall short.
- Conducting at least an annual review of progress against objectives and establish goals for the next period.

PORTABLE LADDERS

- ☐ Are non-slip safety feet provided on each ladder?
- ☐ Is it prohibited to place a ladder in front of doors opening toward the ladder except when the door is blocked open, locked, or guarded?
- ☐ Are portable metal ladders legibly marked with signs reading, "CAUTION - Do Not Use Around Electrical Equipment" or equivalent wording?
- ☐ Are employees prohibited from using ladders as guys, braces, skids, gin poles, or for other than the intended purpose?
- ☐ Are employees instructed to only adjust extension ladders while standing at a base (not while standing on the ladder or from a position above the ladder)?

Work Site Analysis Should Pinpoint Hazards

An objective analysis identifies hazards and enables managers to determine actions to be taken to eliminate the hazard or to develop safe working practices. Employees and managers working together can usually conduct the assessment. If additional assistance is desired it can be obtained from private specialists or through the OSHA consultation program. The following factors are pertinent to a work site analysis:

- Consider using outside expert assistance to conduct the analysis and develop changes to address identified hazards. Use of outside consultants helps keep managers current on newly recognized hazards and methods of dealing with them.

EXIT DOORS

- ☐ Are doors that are required to serve as exits designed and constructed so that the way of exit is obvious and direct?
- ☐ Are windows that could be mistaken for exit doors made inaccessible by means of barriers or railings?
- ☐ Are exit doors openable from the direction of exit travel without the use of a key or any special knowledge or effort when the building is occupied?
- ☐ Where panic hardware is installed on a required exit door, will it allow the door to open by applying a force of 15 pounds or less in the direction of the exit traffic?

- Training employees to conduct a hazard analysis. Assign employees to review particular areas or tasks and periodically review each to ensure that no hidden hazards have crept into the operation.
- Conduct periodic self-inspections to make sure that the hazard controls are effective and that new hazards have not been introduced. The OSHA handbook's detailed checklists are an excellent starting point for self-inspections.
- Provide a means for employees to report safety hazards that they see.
- Establish an accident/incident investigation procedure to ensure that when an accident does occur in which unsafe conditions are implicated, corrective or preventive action can be identified.

Put Hazard Prevention and Control in Place

After identifying hazards, management must prevent or control the hazards. For example, wherever possible, a chemical or equipment hazard should be eliminated by using a less toxic chemical or by replacing a faulty piece of equipment. But this is sometimes not possible, and systems must be set up to control hazards. Some actions to be considered are:

- Establish specific work procedures to be followed when working with the hazard and ensure that employees follow them. This is easier if employees are involved in developing the enhanced procedures.
- Enforce the rules for safe work procedures. Include the employees in devising a disciplinary system that will be impartial.
- Provide personal protective equipment where needed and ensure that employees are trained in its use.
- Conduct periodic drills and analyze employee performance.

ELECTRICAL CAUTIONS

- ☐ Are employees instructed to make preliminary inspections and/or appropriate tests to determine what conditions exist before starting work on electrical equipment or lines?
- ☐ Do extension cords have a grounding conductor?
- ☐ Are all temporary circuits protected by suitable disconnecting switches or plug connectors at the junction with permanent wiring?
- ☐ Are clamps or other securing means provided on flexible cords or cables at plugs, receptacles, tools, equipment, etc., and is the cord jacket securely held in place?
- ☐ In wet or damp locations, are electrical tools and equipment appropriate for the use or location, or otherwise protected?
- ☐ Are metal measuring tapes, ropes, handlines, or similar devices with metallic thread woven into the fabric prohibited where they could come in contact with energized parts of equipment or circuit conductors?

- Ensure that medical facilities are readily available. If problems develop, the employer is expected to get medical help for the individual as well as to address the cause of the injury and/or illness. Emergency numbers should be posted and routes to the nearest medical facility plainly identified.
- Ensure that one or more persons are adequately trained and available to render first aid. Adequate first-aid supplies must be readily available.
- Ensure that any work site with the potential for eye injury or toxic chemical exposure is equipped with eye wash facilities and/or showers.
- Consider retention of a local physician or occupational health nurse on a part-time or on-call basis to advise the company in first-aid planning and training.

Training Key Employees, Supervisors, and Managers

An effective accident prevention program requires that each individual understands the equipment and facilities he or she works with, knows what the hazards are, and knows how those hazards are to be controlled. No employee should be assigned to do a job until he or she has received instructions on how to perform that task safely. An initial safety indoctrination should be a prerequisite before any new employee begins work in a new facility.

Factors that should be considered in developing employee safety training include:

- Ensure that employees have been trained on every hazard in the workplace and that they understand what has been taught.
- Pay particular attention to new employees, as well as any employee transferred to a new assignment that might involve new hazards.
- Ensure that supervisors clearly understand all hazards that exist in their area of responsibility. Supervisors should reinforce employee training with periodic reminders and should discipline those who fail to follow the standard safety procedures.

PORTABLE [POWER-OPERATED] TOOLS AND EQUIPMENT

- ☐ Are rotating or moving parts of equipment guarded to prevent physical contact?
- ☐ Are all cord-connected, electrically operated tools and equipment effectively grounded or of the approved double-insulated type?
- ☐ Are effective guards in place over belts, pulleys, chains, and sprockets on equipment?
- ☐ Are portable fans provided with full guards or screens having openings 1/2-inch or less?
- ☐ Is hoisting equipment available and used for lifting heavy objects, and are hoist ratings and characteristics appropriate for the task?
- ☐ Are pneumatic and hydraulic hoses on power-operated tools checked regularly for deterioration or damage?

Someone in the organization must be designated to be responsible for the safety and health program. The person chosen should be one who is willing to take on the added responsibility and accountability. The success of the program will depend, to a large extent, on the person in charge, but he or she cannot succeed without the full cooperation and support of upper management. ✈

Mr. Fellow is the Editorial Coordinator for the Flight Safety Foundation's Aviation Mechanics Bulletin, the September/October 1995 edition of which this article was taken. OSHA Handbook for Small Businesses, *Document No. 2209, is available from the U.S. Government Printing Office, Superintendent of Documents, Mail Stop SSOP, Washington, DC 20402-9328 or call (202) 738-3238 for ordering information.*

SAFETY ALERTS

A DEFECTIVE MUFFLER AND A VERY GOOD EAR

A retired aircraft maintenance technician (who lives near the airport) called the repair station and stated their aircraft (a Piper *Warrior*) "sounded funny" when it few over his house. The retired technician had an excellent reputation and had received the Charles Taylor Award from FAA.

When the aircraft landed, there was no report of any engine discrepancies or other problems. This aircraft was a flight school rental. An inspection of the aircraft disclosed that the muffler internal flame tube had "burned out." A section of the flame tube was completely blocking the muffler outlet. The engine exhaust system should be thoroughly inspected during scheduled inspections (including preflight inspections).

Thanks to the "calibrated ear" of a conscientious retired maintenance technician, this defect was corrected before further damage occurred.

(From the September 1997 *General Aviation Airworthiness Alerts*.)

NEW PROCEDURE FOR REGISTERING AMATEUR-BUILT AIRCRAFT

The Federal Aviation Administration, Civil Aviation Registry, Aircraft Registration Branch (Registry), currently issues Certificates of Aircraft Registration for experimental aircraft built from kits. In response to a request made by the National Transportation Safety Board, the Registry has modified its procedures and the information required for registration of those aircraft. These modifications will allow the Registry database to reflect the name of the aircraft kit manufacturer. This will ensure that all owners of a given kit model can be readily identified. This will enable aircraft kit manufacturers to use the most current and complete mailing lists for the dissemination of safety information to owners of a specific kit model.

Currently, when an owner makes application for registration of an amateur built aircraft that has not previously been registered anywhere, he must describe the aircraft by class (airplane, rotorcraft, glider, or balloon), serial number, number of seats, type of engine installed, (reciprocating, turbopropeller, turbojet, or other); show the model, and serial number of each engine installed; and state whether the aircraft is built for land or water operation. Also, the applicant must submit as evidence of ownership an affidavit giving the U.S. identification number (if assigned), and stating that the aircraft was built from parts and that he/she is the owner.

Effective October 1, 1998, in addition to the requirements outlined above, the applicant will be required to include the name of the kit manufacturer in the description of the aircraft and submit a bill of sale from the manufacturer of the kit.

A suggested affidavit form, AC Form 8050-88, Affidavit of Ownership for Amateur-Built Aircraft, may be obtained from the Registry by calling (405)954-3116, or accessed at: http://www.mmac.jccbi.gov/afs/afs700/

The complete requirements for registration of amateur-built aircraft can be found in the Federal Aviation Regulations, 14 CFR Section 47.33(a)(b)(c).

CALENDAR OF EVENTS

OCTOBER 3-11. Albuquerque Balloon Fiesta will be held in Albuquerque, NM. An estimated 850 balloons will be participating. For more information call AIBF at 1-888-422-7277.

OCTOBER 19-21. National Business Aircraft Association (NBAA) 51st Annual Meeting and Convention will be held in Las Vegas, NV. For further information call the NBAA at (202) 783-9000.

OCTOBER 23-25. AOPA Expo '98 will be held in Palm Springs, CA. For more information call 1-888-GO2-EXPO.

JANUARY 10-14, 1999. The Parachute Industry Association is holding its International Parachute Symposium in San Diego, CA. Symposium '99 will display the latest in parachute technology, safety, equipment, and training. More than 100 exhibits are supposed to be set up on all aspects of the industry. More than 100 hours of seminars are scheduled.

For more information, contact the Parachute Industry Association, Sherry Schrimsher, Symposium Director, 1315 Cheyenne Drive, Suite 713, Richardson, TX 75080. Telephone (972) 231-4127. FAX (972) 783-8555. Email: hq@pia.com. Web site is www.pia.com.

Flight FORUM

• TOO MANY CATS—CAT I, CAT II, and CAT III(A)(B)(C)

One of the things I learned in my high school English class was that you never use the word you are trying to define in the definition of the word; i.e. an apple is an apple.

In Part 1.1, General Definitions and Abbreviations of the Federal Aviation Regulations, is the following definition. Category II Operations, with respect to the operation of aircraft, means a straight in ILS approach to the runway of an airport under a Category II ILS instrument Approach Procedure issued by the Administrator or other appropriate authority. The same applies to Category III operations.

From this definition can you tell me what Category II or III operations are? And how do they differ from a manually conducted ILS.FAR § 61.67, Category II Pilot Authorization Requirements, which talks about pilot experience and practical test requirements and in (d) practical test procedures while (ix) hints at equipment requirements. I have yet to find a place in the FAR where equipment requirements for Category II ILS's are specifically addressed.

So in summary, to make my old high school teacher happy, let's get Category II out of the definition of Category II—an apple is an apple—Category II is a Category II.

Maybe you could pass this on to the FAR writers.

William H. Silcox
Incline Village, NV

The answer to your question is found in the appropriate U.S. Government's instrument approach procedures chart for those airports with a Category II or III approach procedure. The appropriate landing minimums define your "apple." The primary difference between a Cat I, II, and III approach is their respective landing minimums. Also, Cat II and III approach charts include a statement that special aircrew and aircraft certifications are required.

Regarding the special certifications, in the case of a conflict between an aircrew's and an aircraft's Cat II or Cat III certification minimums, the highest requirements of the two—pilot or aircraft—govern.

For those not familiar with ILS procedures, we did a quick review of FAR Part 1, Definitions and Abbreviations, for ILS category definitions. Although an apple may still be an apple for Category I and II in FAR Part 1, some of the category definitions are in the FAR and other documents. Category III(a), (b), and (c) minimums are defined in FAR Part 1 and the Aeronautical Information Manual (AIM). *The AIM also defines the minimum requirements for Category I and II ILS approaches.*

To help define our "apple," the general landing minimums for a Category I ILS approach are a decision height (DH) of 200 feet and a Runway Visual Range (RVR) of 2,400 feet. The RVR can be 1,800 feet with touchdown zone and centerline lighting. The minimums for a Category II procedure are DH of 100 feet and RVR of 1,200 feet. Category III minimums for III(a) are no DH or DH below 100 feet and RVR not less than 700 feet. Category III(b) minimums are no DH or DH below 50 feet and RVR less than 700 feet, but not less than 150 feet. Category III(c) minimums are no DH and no RVR limitation.

With Category III(c) minimums, a flight crew can land without seeing the runway with proper training and equipment.

Because of the reduced minimums for Category II and III procedures, both require special pilot and aircraft certification as outlined in the FAR.

For readers not familiar with the terms DH or RVR, DH is the lowest point on a precision ILS instrument approach a pilot may descend before the pilot must make a decision to land or to execute a missed approach. RVR is the visibility determined for a particular runway by a transmissometer. If listed, both conditions must be met before a pilot can land.

And yes, for those wondering, an aircraft's wheels may actually touch the runway while the aircraft is executing an ILS missed approach, if the aircraft is very large or it is executing a reduced DH approach. The reason is the DH is the decision altitude where the pilot is expected to make a land/no land decision. The DH is not the minimum altitude for the aircraft on a precision approach before a missed approach is executed. As a result, the momentum of the aircraft may carry it to the runway during the missed approach procedure.

Since we have been talking about

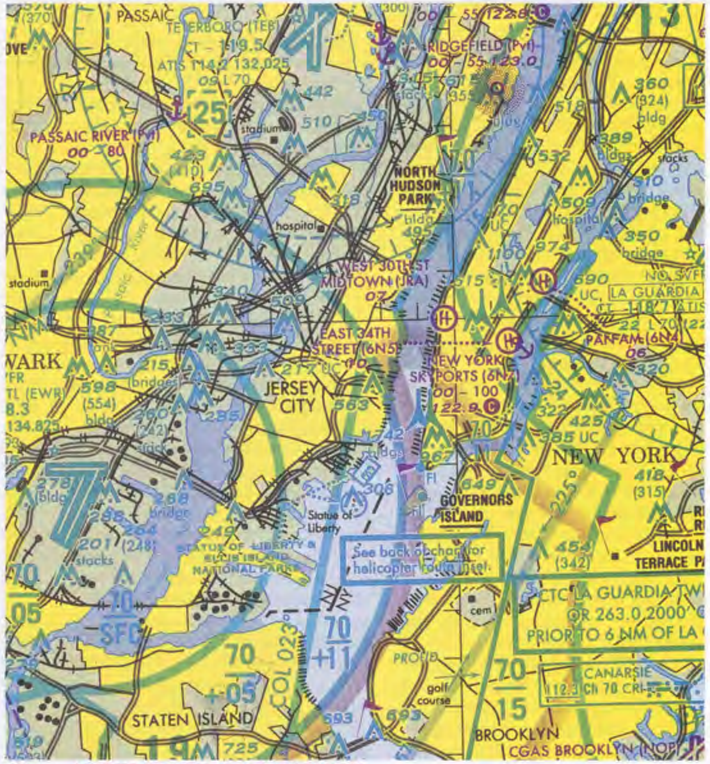
FAA AVIATION NEWS welcomes comments. We may edit letters for style and/or length. If we have more than one letter on the same topic, we will select one representative letter to publish. Because of our publishing schedules, responses may not appear for several issues. We do not print anonymous letters, but we do withhold names or send personal replies upon request. Readers are reminded that questions dealing with immediate FAA operational issues should be referred to their local Flight Standards District Office or Air Traffic facility. Send letters to FORUM Editor, FAA AVIATION NEWS, AFS-805, 800 Independence Ave., SW, Washington, DC 20591, or FAX them to (202) 267-9463; e-mail address: Dean.Chamberlain@faa.dot.gov

apples, we all must remember the story about Newton sitting under an apple tree, and how he came to describe gravity. Both apples and aircraft are subject to gravity, and both will fall unless handled carefully. We hope we have described both accurately.

• What Gives?

I recently heard that the FAA is going to violate all airmen who use the VFR corridor over the Hudson River near New York City because aircraft can't maintain the distance requirements-1,000 feet above something within a 2,000-foot radius of the aircraft-from the nearby buildings, namely the twin towers of the World Trade Center. Is this a trick? Why put it on the chart if you're going to violate us for using it?

Don Lewis, CFII
Coram, NY



NOT TO BE USED FOR NAVIGATION.

The short answer is, "No, you've been listening to malicious rumors," but everyone deserves a detailed explanation concerning this.

The VFR corridor referred to is the chunk of airspace over the Hudson River west of New York City, which allows VFR traffic to transit a busy air traffic area without being routed out over the Atlantic Ocean or far inland. (See the accompanying graphic.) The corridor is depicted best on the New York Class B Airspace VFR Terminal Area Chart. When pilots stay below 1,100 feet MSL and remain over the water of the Hudson River, they are in uncontrolled airspace and do not have to be in contact with air traffic control.

The FAA's Eastern Region recently had a spate of incidents where pilots, instead of staying over the water, strayed to one side or the other of the corridor and ended up over congested areas. FAR § 91.119(b) states that when over congested areas, pilots must remain 1,000 feet above the nearest obstacle within a 2,000-foot radius of the aircraft. Consequently, when pilots do not stay within the confines of the corridor, they could be in non-compliance with the minimum safe altitude requirements of FAR § 91.119(b).

However, FAR § 91.119(c) allows that when you are over water you need remain only 500 feet away from any "person, vessel, vehicle, or structure." Again, operating completely within the confines of the corridor allows a pilot to be in compliance with this regulation.

FAA's Eastern Region issued a letter emphasizing this distinction to area pilots, and so some confusion must have occurred. While operating in the corridor, if you remain over the water, below 1,100 feet MSL, and 500 feet from any person, vessel, vehicle, or structure, you'll be just fine. A big reminder, though, from our FAA Aviation News Editor, who used to fly that corridor regularly, you need to keep a sharp lookout for traffic, particularly helicopter traffic, and know your right of way rules for overtaking slower aircraft.

FOURTH ANNUAL MARYLAND SAFETY SUMMIT

FAA inspectors from the Maryland FSDO and local industry representatives discuss items of interest for Maryland airmen. (H. Dean Chamberlain photo)

With its theme of "Making a Difference by Going Above and Beyond," the 4th Annual Maryland Safety Summit was bigger and better than ever, so said the participants. For the past four years, the FAA's Maryland Flight Standards District Office (FSDO) has held a summit, inviting the Maryland aviation community to assist in outlining the FSDO's priorities for the next fiscal year.

In morning sessions, local aviation officials, airport operators, and just plain pilots and mechanics broke out into work groups covering issues to do with air carrier, airworthiness, airports, and flight training. In the afternoon, they were joined by FAA inspectors who took copious notes on the morning's proceedings. Says Maryland FSDO Manager Rich Lea, "This way we get to hear what's important to our constituents, and our communication with the local aviation community keeps improving." Issues raised by the four work groups will be reflected in the work program that Maryland FSDO inspectors will carry out in fiscal year 1999, beginning on October 1, 1998. "It assures that our limited resources go to where they are needed most," said Lea.

The luncheon speaker was Aircraft Owners and Pilots Association President Phil Boyer, who spoke about current issues affecting general aviation today and in the future.

Along with the Maryland Aviation Administration (MAA) and Maryland Aviation Historical Task Force, FAA participated in the Maryland Aviation Awards Ceremony after the working meeting was concluded. The Maryland Aviation Pioneer Award, presented by the Maryland Aviation Historical Task Force, went to John K. "Jack" Crawford of Maryland Airport and Mary S. Feik, from Annapolis, MD.

MAA presented its Airports of the Year Awards for most improved facilities to Maryland Airport in Indian Head, MD (privately owned, public use) and to Greater Cumberland Regional Airport in Cumberland, MD (public owned, public use).

FAA presented Wright Brothers Master Aviator Awards to four local pilots who had 50 years of continuous pilot currency since original certification as a civilian or military pilot. The recognition went to Messrs. Warren W. Baker of Baltimore, Paul A. Ennis of Salisbury, Herbert C. Gussin of Stevensville, and Richard R. Johnson of Deale. FAA's Appreciation Award went to the former Operations Unit Supervisor at the Maryland FSDO, George Galo, and to the Maryland Wing of the Civil Air Patrol for "significant contributions to aviation safety."

The FSDO named Robert O. Danzi of Salisbury as the winner of the local AMT of the Year Award. The CFI of the Year Award went to William J. Pierson, Jr. of Baltimore.

Finally, the FSDO recognized the hard work and dedication of its Aviation Safety Counselors by presenting its Safety Volunteer of the Year awards to ASC's David and Marie Summerfield.

Next year's summit will be held in its now permanent location, Maryland's Maritime Institute of Technology, in mid-June 1999. For further information, contact Ms. Wendy L. Grimm, Maryland FSDO Safety Program Manager, at (410) 787-0040.

BUSINESS WINGS

The National Air and Space Museum here in Washington, DC, has opened a new exhibit featuring the business use of aircraft. The exhibit, "Business Wings," highlights the many benefits that aircraft have added to business and commerce from the earliest days of aviation. The exhibit details the history of business aircraft through photographs, text, video, and interactive displays from aviation's earliest days to today's latest intercontinental jet aircraft.

The exhibit includes a Beech *King Air* Model 90 and the second Cessna

Citation 500 model built. The *King Air*, which is suspended from the ceiling, includes a novel joy-stick controlled video camera located within the aircraft that allows people to view the interior of the aircraft on a display monitor. By manipulating the joy-stick, visitors can check out the passenger area, as well as views of the cockpit area including a pilot's view out the front windshield.

The exhibit is sponsored in part by the National Business Aviation Association, Inc. and its BASIC Fund.

Visitors enjoy the new Business Wings exhibit at the Air and Space Museum. (Smithsonian Photo)

SUSPECTED UNAPPROVED PARTS PROGRAM STEERING COMMITTEE PRESENTS AWARD

Peter Gallimore, Boeing Aircraft's Director of Regulatory Coordination for Manufacturing and Repair Quality Assurance and Chairman of the aviation industry's volunteer Suspected Unapproved Parts Program (SUPP) Steering Committee, recently presented Ken Reilly, Manager of the FAA's Suspected Unapproved Parts Program, AVR-20, an award for his leadership efforts in the fight against suspected unapproved parts in the aviation industry. Reilly has been manager of the Suspected Unapproved Parts Program since 1996.

The SUPP's Steering Committee works with the FAA on developing procedures and policies on SUPP's issues for both FAA and industry. The SUPP's Steering Committee is a representative group of Aviation Industry Professionals recognized by the FAA to provide guidance and feedback to AVR-20 regarding the development of literature, programs, and policies for implementing SUP initiatives.

The award's engraved message is self-explanatory, "To Ken Reilly, In Appreciation For Your Leadership, Dedication, And Service in the Suspected Unapproved Parts Program. From your Friends serving on the SUPP's Steering Committee, a group of industry professionals representing the Major and Regional Airlines, Repair Stations, Consultants, Distributors, Trade Associations, and Manufacturers."

According to a SUPP's Steering Committee member, Roy Resto, Vice President of Operations at Quality Management Solutions LP, "Ken Reilly and his staff have accomplished an excellent job of balancing the needs of industry, Congress, and the various FAA constituencies. Given the media attention the FAA has been given, we all felt that this recognition was long overdue. He and his staff are representative of the professionals at the FAA who are forging new ties with industry in an effort to implement effective solutions to safety initiatives."

Peter Gallimore (left) with SUPP Manager Ken Riley. (H.Dean Chamberlain photo)

Editor's Runway

LISTENING WITH YOUR SOUL

by Joel D. Wilcox

This issue I'm happy—and the readers probably are too—to relinquish the editorial space to the following. All we ask is that you read it through to the end to see how it connects to aviation safety.-Editor

A few weeks ago I made a different kind of flight from what I'm accustomed to.

I had just driven safely across the U.S. for a job reassignment within the FAA. I had been the Regional Safety Program Manager in Alaska, and now I'd be in Washington, DC, where I'd continue to work with the Aviation Safety Program's national office.

But first I thought I'd stop at my sister's place and help her move into her "new" 100-year old home. That's where I made the flight.

I flew down her stairs.

I say flew because the stairs of the old house are the narrowest and steepest that I've seen in a home. When I missed the top step(with box in hand) and fell forward, I sailed over just about every other step before slamming into the floor at the bottom and up against a door.

I was definitely cleared direct.

But wait. Why write about a household accident in an aviation magazine?

Because in saving my neck—literally—I broke both my hands. Besides taking this personally, I missed a week of work while waiting for the pain to subside. It took three more weeks for the splints to come off, during which time I was a terribly inefficient employee, with both hands largely out of commission. I also had to endure all the "damaged safety inspector" jokes. (My sister's neighbor said he'd called the FAA to see if they could come and investigate the scene of the crash.)

And, of course, I couldn't fly. I'm still not flying, since it will be another month or so before I regain full strength in both hands. Obviously, when we're hurt everything suffers as we do—including our families. My family was inconvenienced for a time when there was very little I could do for myself or them.

Some years ago a friend's mother was killed instantly when she fell head-first down her basement steps. After my "flight" when I looked into it, I found that this sort of trauma in the home happens far more than I realized. The National Safety Council reports there are nearly three times more home injuries (disabling injuries beyond the day of injury) as auto injuries, and about two-thirds more deaths. The most common cause of death at home: falls, followed by poisoning and burns.

I found after my fall that my thinking process about descending a staircase is forever changed. I'm not more fearful, just more aware of what I'm doing.

This brings to mind some questions: Did I have to fall down a staircase for this change in thinking to happen? Suppose, over the previous year or so, I had been reading articles and attending meetings on staircase safety. Could these have had the same gut-level influence on me?

I believe so, but only if I'd been listening very strongly—with my soul.

Such is the challenge of the Aviation Safety Program and the responsibility of its participants.

We're happy to report that Joel is fully recovered and back in the air and now brings a new perspective to the Aviation Safety Program.

'Til next time...

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